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PERFORMANCE**

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AN EMPIRICAL ASSESSMENT OF THE IMPACT OF SWITCHING COSTS AND FIRST MOVER ADVANTAGES ON FIRM PERFORMANCE*

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Abstract

The purpose of this paper is to test the effectiveness of switching costs as an isolating mechanism in the context of the first mover advantage theory. Whereas both the literatures on switching costs and pioneering propose this as a mechanism through which firms could obtain sustainable competitive advantage, other authors offer a rationale to think that this is not the case. We test our hypotheses in the context of the European mobile telecommunications industry. This is a sector that has been characterized by high rates of growth in the number of subscribers, what could reduce the effectiveness of switching costs from being effective as an isolating mechanism. Our results show that switching costs is an important weapon through which first mover advantage materializes.

Keywords: first mover advantages, mobile industry, pioneering, switching costs

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1. INTRODUCTION

The study of firm's competitive advantage has one of its cornerstones on the concept of first mover advantages. Most of the theoretical literature suggests that companies that enter first in the market perform better than later entrants. First mover advantages are argued to be achieved through technological leadership, pre-emption of superior resources or customer switching costs (Lieberman and Montgomery, 1988). Accordingly, the suggestion that pioneers are more profitable than followers has received intense attention in the empirical literature.

Two main ideas attract our interest in this paper. On the one hand, although the literature has argued that switching costs are important as a way of preserving the advantage of the pioneer (Lieberman and Montgomery, 1988), to our knowledge there has been no attempt to assess their influence directly. Switching costs may arise as a result of a customer's specific investments on a provider, such as the ones that derive from familiarity with certain procedures and policies or proficiency in the use of a given technology. Once they have been created, they may serve as a means for price increases or quality reductions and, hence, to lock the consumer into a profitable relation for the firm.

Despite the importance of switching costs for the first mover advantage concept, the effectiveness of this mechanism as the base for a sustainable competitive advantage has been put into question, at least in the context of the provision of information technologies. Thus, Mata, Fuerst and Barney (1995) argue that there are three reasons why switching costs should not be considered as a source of sustainable competitive advantage. First, buyers are likely to assess the risks of ending locked-in to a given provider and, therefore, they will only engage in the relationship if they are offered guarantees of not being expropriated in the future. Second, those providers who took

advantage of switching costs to profit would earn a reputation of low reliability. Finally, buyers are usually confronted before the offers of many different providers, which, again, lowers the relevance of switching costs as a source of competitive advantage. Despite these arguments, recent research that focuses on the information economy, postulates that switching costs are one of the main sources of sustainable competitive advantage (Shapiro and Varian, 1998; Amit and Zott, 2001). Accordingly, our main objective in this paper is to test the extent to which switching costs have an independent influence on profitability and/or whether they *mediate* the relationship between the first mover advantage and performance. Importantly, the prevalence of a mediation effect would mean that switching costs are one of the mechanisms explaining the performance advantages of leaders and it would clearly relate the literatures on first mover advantages and switching costs on empirical grounds.

On the other hand, we perform a test for the first mover advantage in a setting that could be described as an *extreme case* for the theory, at least in one of its dimensions. We focus our analysis of first mover advantages on the European mobile communications industry. This is an industry where the pace of market evolution has been characterised by high rates of growth in the number of subscribers of mobile services. Recent research on first mover advantages has concentrated on the role of a firm's environment as either an enabler or disabler on the isolating mechanisms mentioned above (Suárez and Lanzolla, 2007). Specifically, two main environmental factors have been proposed to affect the existence of early moving benefits: the pace of technological evolution and the pace of market evolution. Based on their review of the literature, Suárez and Lanzolla (2007) argue that a slower pace of both technological and market evolution should favour the sustainability of first mover effects. Thus, they conclude that first mover effects should have a weak effect or become a strong disabler

in those cases in which the pace of market evolution is abrupt. This would suggest that first mover advantages should be short-lived in high growth markets.

The use of the mobile telecommunications industry as the object of our analysis also provides us with additional opportunities for extending the empirical evidence on first mover advantages. On the one hand, although there are some exceptions (see, for example, Mascarenhas, 1992), a great deal of the evidence on first mover advantages refers to just one country. Rather than focusing on the analysis of first mover advantages in different sectors of an economy, we follow the evolution of the same industry across different countries. This gives us the possibility for controlling for the differences in the institutional and competitive environments and follows the claim by Nehrt (1998: 94) to “internationalize research in the first mover and maintainability literatures”. On the other hand, although the use of market share as the dependent variable for testing early mover advantages is usual, the likelihood of finding a positive effect is higher than with other performance measures (VanderWerf and Mahon, 1997). In fact, ten years ago Lieberman and Montgomery (1998) pointed out that research on first mover advantages should be related to profitability and not to market share. Accordingly, we perform a test of first mover advantages that relies on both market share and profitability and comment on the differences between both models.

The rest of the paper is structured as follows. The next section develops the hypotheses on early mover advantages, focusing on the relevance of switching costs. Then, we describe the data base and the methodology that is used in the empirical tests. Finally, we provide evidence showing the importance of switching costs on the sustainability of first mover advantages in the mobile industry and close the paper with the main conclusions and implications for practice and research.

2. HYPOTHESES

First mover advantages and performance. The idea that first moving can confer a competitive advantage to pioneers is well established in the literature of strategic management. Three are the main isolating mechanisms usually referred to explain performance advantages accruing to first moving firms (Lieberman and Montgomery, 1988). First, pioneers may benefit from technological leadership. Thus, they may produce at lower costs thanks to experience or learning curve advantages or they may enjoy the protection of patents in those markets in which competition in research and development is important. Second, first moving firms are likely to be able to preempt competitors in the acquisition of certain assets, such as favorable locations or better trained human resources. Finally, pioneers can also benefit from switching costs and buyer inertia under uncertainty. In the first case (switching costs), firms following in the market confront higher costs to attract those customers that are locked-in with the product offered by the pioneer. In the second (buyer uncertainty), research in the economics (Schmalensee, 1978) and marketing literatures (Carpenter and Nakamoto, 1989) suggests that consumers tend to favor those brands they have previously found satisfactory or have a distribution of preferences that is biased towards the product offered by the pioneer.

Empirical research on early moving advantages offers an ample variety of methods, industry settings and results. Perhaps one of the most comprehensive accounts of the evidence on first mover advantages is provided by Vanderwerf and Mahon (1997). From a meta-analysis, these authors conclude that the majority of empirical tests undertaken in the academic literature (54 out of 66) show significant first mover advantages. Importantly, they also point out that the results were clearly dependent on several methodological procedures used by researchers. Thus, pioneers were attributed a

first mover advantage in those cases in which (1) there was an absence of competitive variables capturing the various weapons that could be used by rival firms, such as advertising or R&D investments, (2) market share was used as the dependent variable or (3) the selection of individual industries was performed by the researcher.

Despite these methodological limitations and the recognition of first mover disadvantages (Lieberman and Montgomery, 1998; Suárez and Lanzolla, 2007), research has shown the importance of early mover advantages in different contexts. Thus, we enunciate our first hypothesis as follows:

Hypothesis 1: *pioneers do show performance advantages over later entrants*

Switching costs in the context of first mover advantages

Despite the amount of papers dedicated to the investigation of consumer behaviour and customer switching costs, to our knowledge, no research has attempted to measure their impact in a context of early mover advantages. The concept of switching costs refers to all the costs that a consumer has to bear when changing her current provider of services. Therefore, the concept applies to all the situations in which a consumer has already bought and used a unit of a service or product from a particular provider and is given different options to consume additional units that involve making a new specific investment. In these cases, consumers would show a preference for compatibility -vertical compatibility- between the investment already committed and the new ones needed in order to extract enough utility from the additional unit purchased (Kemplerer, 1995).

The literature on first mover advantages has stressed the relevance of switching costs at building the performance advantage of the pioneer. Switching costs are one of

the isolating mechanisms proposed by Lieberman and Montgomery (1988) to explain first mover advantages. In particular, their existence provides early entrants with an initial customer base that may be, at least, partially locked-in (Bijwaard *et al.*, 2007). Through pioneering, early entrants may create switching costs in two dimensions. First, in a context characterised by the absence of competition -generally the early stages of the market-, they may be able to quickly attract consumers. The objective of pioneers in the early stages of the industry life cycle is to build an installed base as big as possible, widening the number of consumers that are locked-in. Second, they may be also able to increase the magnitude of switching costs for an individual, through product specific investments that are time dependent (for example, loyalty programs). When late newcomers appear in the market and locked customers confront the decision of where to purchase a new unit of the service, they may found that they are positively conditioned to maintain their current provider, given the investments already committed. Customer lock-in may not only have a direct effect on the maintenance of the market share acquired by the pioneer. It also provides the bases for this advantage to be translated into profits: those consumers who have invested in a current provider would be locked-in as long as the price premium charged by the pioneer is lower than the costs of switching.

Despite the recognition of the importance of switching costs and the wide variety of situations in which they may arise, the literatures on switching costs and on first mover advantages have largely evolved separately. This shortcoming is especially important from the point of view of the literature on first mover advantages. In fact, the influence of switching costs on performance could be double. On the one hand, switching costs could be an independent mechanism acting (in different degrees) in favour of all the firms in certain markets. On the other hand, these costs could explain,

either completely or to a certain extent, the relationship between first moving and profitability. In the first case, our expectancy would be that switching costs would provide a competitive advantage for the firms possessing them and an *independent* effect on profitability and/or market share. Thus, this variable should show a positive impact on profitability in a model of firm performance. This is reflected in Hypothesis 2.

Hypothesis 2: *switching costs have a positive effect on firm performance*

Following our reasoning, switching costs could also be an important mechanism through which first movers obtain performance advantages. Therefore, switching costs should *mediate* the relationship between first moving and performance. The corresponding hypothesis is developed below.

The mediation effect of switching costs on the first mover advantage

Ideally, a satisfactory test of the first mover advantage hypothesis should show that the variable accounting for early moving loses either magnitude or significance as the mechanisms that create the advantage are properly taken into account in the performance equation. Researchers on the first mover tradition have made an important effort to explain the first mover advantage in terms of the isolating mechanisms that protect pioneers from subsequent competition. For example, Srinivasan, Lilien and Rangaswamy (2004) examine the effect of network externalities on pioneer survival and Lieberman (2005) considers the impact of proprietary technology on the advantage of pioneers in Internet markets. Nevertheless, to our knowledge, switching costs have not been explicitly measured and introduced in the performance equation.

The ideas presented in the last sections point to the fact that switching costs are, in fact, one of the mechanisms underlying the first mover advantage. In particular, the arguments provided lead us to think that firms which entered the market first should profit to a higher degree from the existence of switching costs in their customers. Those firms entering late would suffer from the disadvantage of having to improve their offers in order to attract the customers of the pioneer, who are locked-in. Thus, as the theory suggests, switching costs could contribute to the explanation of the first mover advantage.

This reasoning suggests that switching costs should *mediate* the relationship between the first mover advantage and firm performance. Baron and Kenny (1986) explain that a test for mediation should include three conditions. First, the mediator (switching costs) must be explained by the independent variable (first moving). Second, the effect of the independent variable (first moving) on performance should be positive when the mediator (switching costs) is absent. Finally, the last condition that should hold is that the introduction of the mediator (switching costs) in the performance equation should be significant and, at the same time, the effect of the independent variable (first moving) should either decrease in magnitude or disappear. As an extreme case, *perfect mediation* should mean that the direct effect of pioneering on performance should not be significant. Thus, the explanation of the first mover advantage would be completely attributed to the isolating mechanism. Following all the previous arguments, our last hypothesis reads as follows.

Hypothesis 3: *switching costs mediate the relationship between pioneering and performance*

3. SAMPLE AND VARIABLES

The mobile communications industry in Europe

The empirical application of this research is performed in the European mobile communications sector. The data available describe the evolution of mobile telecommunications in 19 European markets between 1998 and 2007.¹ This sector is especially appropriate for our purposes for several reasons. First, entry in the mobile telecommunication industry has taken place in a number of waves, which allows us to properly identify different groups of operators depending on their entry timing. Second, as it was mentioned in the introduction of the paper, although there are some exceptions (see, for example, Mascarenhas, 1998), most of the evidence on first mover advantages refers to just one country. Contrarily, our paper focuses on the analysis of early mover advantages in the evolution of the same industry across different countries. Third, mobile communications is an industry in which the level of switching costs is high (Lee *et al.*, 2006; Grzybowski, 2007). In fact, Bijwaard *et al.* (2007) suggest that switching costs are likely to be the main source for early mover advantages in mobile communications.

Some relevant characteristics of this industry should be mentioned. First of all, it is important to highlight that both the development and the evolution of the industry has been managed in supranational arenas. This has provided homogeneity and favoured, for instance, roaming agreements among European countries. In addition, GSM and UMTS were established as technology standards for mobile communications in the Euro zone. The decision to provide homogeneity has important implications concerning

¹ The European countries considered in our research are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

technology evolution, namely, that setting common standards has limited the capacity of firms to compete on innovation.²

Second, the radio spectrum is considered a scarce resource and entry is regulated by the Governments through licensing. Therefore, companies must acquire a licence to operate in a particular market, either by auction or by beauty contest. These licences usually imply certain commitments in terms of infrastructure development and coverage.

Finally, it is important to note that the European mobile communications industry has grown impressively in recent years. Its average penetration rate has increased from around 30% at the end of 1998 to slightly over 100% at the end of 2007. Gruber and Verboven (2001a, 2001b) have analyzed this process all over the world and postulate that this rapid diffusion can be attributed to the setting of one single digital standard (which implies a substantial reduction in costs, with the subsequent effect on prices) and to the introduction of competition in the second generation technology. Doganoglu and Grzybowski (2007) complement this view, pointing out that this fast development has had an additional driver: the presence of a technology with relevant network effects. In essence, this rapid growth provides us with an extreme scenario in which to test the relevance of first mover advantages.

Variable construction

The principal source of data for our empirical analysis is the Merrill Lynch Global Wireless Matrix. This publication gathers quarterly information on several of the variables of interest, such as the name of the operator, the number of subscribers or its performance. These data have been complemented with information from other sources,

² Gandal (2002) discusses the implications of setting a common standard vs. leaving the market to determine one (or several) of them. In our case, the *exogeneity* in the pace of technology evolution (Suárez and Lanzolla, 2007) could mean that this dimension would have a secondary role in the context of European mobile communications.

such as the International Telecommunications Union, the Heritage Foundation and the International Monetary Fund. More details are provided below.

Dependent variable

Most research on first mover advantages uses market share as the dependent variable. According to previous research this increases the likelihood of finding them (VanderWerf and Mahon, 1997). In addition to that, Lieberman and Montgomery (1998) advice the use of profitability as a more adequate measure when performing a test of first mover advantages. Given the availability of data on both market share and profitability we use both variables in our empirical tests. The two measures proposed are defined as follows: (1) market share is the number of users subscribed to the services of operator *i* in country *j* divided by the total users in country *j*; (2) the profitability of firm *i* is measured through the variable EBITDA (Earnings Before Interests, Tax, Depreciation and Amortization divided by Total Revenues) in country *j*. The availability of data allows us to use quarterly information on both variables.

Independent variables

Time in market and order of entry. Different concepts of pioneering (hypothesis 1) have been used when modelling first mover advantages. In fact, Brown and Lattin (1994) point out that there has been some disagreement in terms of what pioneering exactly means. Thus, whereas some researchers only use the order of entry as their main variable, other authors combine it with complementary variables. Thus, Urban, Carter, Gaskin and Mucha (1986), in their model of relative market share, use what they call the lag between entries, measured as the number of years elapsed between the entries of two different brands. In a similar vein, Brown and Lattin (1994) introduce the ratio between the time in market of a late entrant and the time in market of the pioneer in a market share attraction model.

Ideally, our identification of first movers should take into account two ideas. First, differences in time in the market should explain why some firms earn more profits than others. Accordingly, the first variable counts the number of years that a firm has been operating. Second, given that we have 19 independent markets and the first mover advantage should be related to the order of entry in each of these markets, we also define a second set of dummy variables that takes into account whether the firm is the pioneer, the second entrant, the third entrant or a late follower, with the last category serving as the base case.

Switching costs. Apart from the idea of first mover advantages, our hypotheses concentrate on the role of switching costs as a mechanism explaining differences in performance. Therefore, we need a reasonable way of calculating the level of switching costs for every period and firm included in the sample. This measure should reflect the costs in which an average user incurs in case of changing between brands.

As mentioned above, switching costs are the costs that a consumer has to bear when switching to a competitor's product; even when the products of two firms are functionally identical (Klemperer, 1995). According to the existing literature, there is an important gap between the theoretical and the empirical research on switching costs (Stango, 2002; Grzybowski, 2007; Chen and Hitt, 2007; Viard, forthcoming). Perhaps this is the reason why there have only been a few attempts in order to properly measure their magnitude. Two exceptions are found in Chen and Hitt (2002) or Grzybowski (2007), who use a random utility framework to model users' choice, concluding that when switching costs are present, the previous choice influences current utilities. A third attempt is the one proposed by Shy (2002), who uses a different approach for modelling switching costs. This author develops *a quick-and-easy method for*

estimating switching costs among companies where only prices and sizes are needed to calculate them. This is the method we use for building our measure of switching costs.

Shy's model starts with the following assumptions. He considers a market with only two firms called firm A and firm B . Consumers are assumed to be distributed between the firms so that initially N_A consumers have already purchased brand A (type a consumers), and N_B consumers have already purchased brand B (type b consumers); p_A and p_B represent firm A and B prices respectively, and s the cost of switching between brands. The utility for a user who is now buying from A , U_A (the case of U_B is analogous) can be written as,

$$U_A \stackrel{def}{=} \begin{cases} -p_A & \text{staying with brand A} \\ -p_B - s & \text{switching to brand B} \end{cases}$$

The number of subscribers for A (B), n_A (n_B) in the following period is given by,

$$n_A = \begin{cases} 0 & \text{if } p_A > p_B + s \\ N_A & \text{if } p_B - s \leq p_A \leq p_B + s \\ N_A + N_B & \text{if } p_A < p_B - s \end{cases}$$

If we assume that firms' production costs are zero, the profit, π_A (π_B), of each firm is,

$$\pi_A(p_A, p_B) = p_A n_A$$

Shy (2002) postulates that the pair of prices that solve the problem for the firms A and B and constitute a Nash-Bertrand equilibrium are:

$$p_A = \frac{(N_A + N_B)(N_A + 2N_B)s}{(N_A)^2 + N_A N_B + (N_B)^2} \quad \text{and} \quad p_B = \frac{(N_A + N_B)(2N_A + N_B)s}{(N_A)^2 + N_A N_B + (N_B)^2}$$

Shy (2002) extends the model to a multifirm industry. He considers that there are $I > 2$ firms, each indexed by i , $i = 1, \dots, I$. The expressions for switching costs in a multifirm industry are:

$$s_i = p_i - \frac{N_I p_I}{N_i + N_I}, \text{ if } i \in \{1, \dots, I-1\} \text{ and } s_I = p_I - \frac{N_1 p_1}{N_1 + N_I}$$

Then, to calculate switching costs *a la* Shy, a precise measure of sizes and prices is needed. Sizes are incorporated in the switching costs function through the installed bases of the operators, that is, their number of users. A more controversial issue is to define prices in mobile communications. Calculating a homogeneous price for the service charged by each mobile operator is a difficult task. Prices usually include a set of tariffs that differ depending on the receiver of the phone call (on-net vs. off-net calls), the time of the day or the characteristics of the user. To solve this problem, Doganoglu and Grzybowski (2007) use all the available information about tariffs to calculate prices in Germany. However, this option is almost unfeasible in a sample that includes several countries. Grajek (2007) determines the price of each provider as the lowest bill (that reflects the best deal selection) of an average customer. Shy (2002) derives prices from Average Revenue per User (ARpU) in his calculation of switching costs in mobile communications in Israel. Choosing ARpU as a reference for prices has the advantage of homogeneity among countries, making comparisons possible. Moreover, the use of ARpU is also motivated by “its widespread use in industry and regulatory circles” (McCloughan and Lyons, 2006:523).

Control variables

In addition to the variables used to test the hypotheses developed above, we also control for other factors. First, we calculate a measure for country specific rivalry. A country Herfindahl is constructed using the market share of each operator in the country in which it develops its activities. Our expectation is that more concentrated countries

should show higher profitability, that is, we expect a positive and significant sign. Second, we also control for differences in per capita income and economic freedom among countries. For the first measure we use the data provided by the International Monetary Fund on the 19 countries included in the sample. For the second, we use the Index of Economic Freedom developed by the Heritage Foundation. We would expect higher per capita income to have a positive impact on performance, given the larger amounts of money that could be dedicated to mobile services by the consumer. Contrarily, a higher index of economic freedom should mean that market forces are more important in a given country, making profitability more difficult to sustain.

Descriptive Statistics

Table 2 shows the evolution of the number of operators by period and number of years in the market, from the last quarter of 1998, the first period for which data is available, to the first quarter of 2007. The number of firms ranges from 52 at the beginning of our observation period to 69 at the end. Similarly, the number of operators varies from 3 to 5 depending on the country analysed. The distribution of the number of firms by country is relatively stable, with a few entries and exits during the period considered. In particular, it is hardly difficult to find operators that exit their respective markets. However, some entries took place coinciding with the licensing of the 3G technology. It is also important to note that network operators may sell services to consumers directly or indirectly through mobile virtual network operators (MVNO). However, the availability of data does not allow us to consider MVNO.

Tables 3 and 4 show descriptive statistics and correlations among the variables that will be included in the analysis. Both tables are divided in two parts, with the first making reference to the market share model and the second to the profitability model. As it may be observed, the existence of missing values in our dependent variables

means that we are left with 1,491 observations for the market share model and 1,363 for the profitability model.

4. RESULTS

Table 1 shows robust estimates of our market share and profitability equations. For testing our hypotheses we proceed in three stages. First, for testing hypothesis 1 we estimate a model in which the switching costs variable is absent and introduce the variables measuring the first mover effect. Second, we test hypothesis 2 by estimating a coefficient for the switching costs variable in the absence of the first mover advantages variables. Finally, we test a full model, taking into account both, the effect of first moving and switching costs on market share and profitability. As mentioned above, for hypothesis 3 to be supported we need first moving to be significant for market share and profitability. At the same time, the full model should show that the magnitude of the effect of first moving on market share and profitability should either be reduced or eliminated when the switching costs variable is introduced in the estimations.³

Focusing on the market share equation, we may see as all the models estimated present a global fit above 0.41, as measured by the R-Squared statistic, with the full model having the highest value and being preferable to the other two, as it may be inferred from the F-tests presented at the bottom of the table. Interestingly, all the variables capturing the first mover effect are highly significant, especially in the case of the order of entry variables. Both time in the market and the order of entry have a positive effect on the market share of the operator, leading to the conclusion that first moving is important in this market. It is also important to note that the dummy of the pioneer has a higher value than that of the second entrant and this variable, in turn, has a

³ The other condition for switching costs to be a mediator is that it should be explained by first moving. This condition is satisfied for both samples.

higher value than that representing the third, supporting hypothesis 1. Both per capita income and the Index of Economic Freedom have significant impacts on market share, although of different sign. Per capita income shows a positive impact on market share, whereas the influence of the Index of Economic Freedom is significant and negative.

Equation 2 introduces the switching costs variable in the estimations in a model in which we eliminate the variables measuring first moving. The coefficient is positive and significant, meaning that switching costs have an important influence on market share and supporting hypothesis 2. Per capita income loses its significance in this model, whereas the Index of Economic Freedom is still significant and negative.

Finally, equation 3 attempts to test the mediation effect of switching costs. For achieving this we estimate a full model in which market share depends on both first moving and switching costs and in which all our control variables are also introduced. Several points are noteworthy. First, both the set of variables capturing first mover effects and switching costs are significant and positive. Interestingly, all the 5 coefficients are smaller than the ones resulting from the separate estimations performed in equations 1 and 2. For example, the estimated effect of the switching costs variable is almost a half (0.0045 vs. 0.0081) of the one calculated in model 2. Moreover, the pattern commented for the order of entry variables remains stable, with the pioneer having a higher market share than the second entrant and the latter also having a larger coefficient than the third. Finally, the Index of Economic Freedom variable remains negative and significant.

Table 1. The effect of pioneering on market share and profitability (robust estimates)

Dependent variable	Market share (1)	Market share (2)	Market share (3)	Profitability (4)	Profitability (5)	Profitability (6)
Time from entry (years)	0.0032*** (2.85)	---	0.0025*** (2.74)	0.0401*** (10.65)	---	0.0388*** (11.60)
Pioneer	0.3426*** (30.74)	---	0.2675*** (23.81)	0.2206*** (3.90)	---	0.0521 (0.95)
Second entrant	0.2082*** (25.13)	---	0.1419*** (14.57)	0.2139*** (3.62)	---	0.0591 (1.04)
Third entrant	0.1206*** (19.54)	---	0.1017*** (12.54)	0.1694*** (3.00)	---	0.0814 (1.35)
Switching costs	---	0.0081*** (31.72)	0.0045*** (19.19)	---	0.0116*** (6.72)	0.0075*** (5.01)
Concentration	---	---	---	0.0881 (0.29)	-0.4597 (-1.50)	-0.0106 (-0.03)
Per capita income/10,000	0.0238*** (3.65)	-0.0116 (-1.63)	0.0047 (0.78)	-0.0152 (-0.49)	0.0105 (0.44)	-0.0492* (-1.94)
Index of Economic Freedom	-0.0017*** (-2.91)	-0.0028*** (-5.10)	-0.0017*** (-3.30)	-0.0030* (-1.94)	-0.0056*** (-3.24)	-0.0034** (-2.19)
Constant	0.0947*** (3.12)	0.3844*** (13.44)	0.1254*** (4.81)	-0.0057 (-0.04)	0.5959*** (4.58)	0.1626 (1.05)
Number of observations	1,491	1,491	1,491	1,363	1,363	1,363
Adjusted R-Squared	0.5969	0.4136	0.6838	0.2173	0.1581	0.2865
F-test vs. 1(4)	---	---	368.13***	---	---	25.11***
F-test vs. 2(5)	---	---	303.12***	---	---	61.94***

***, **, * Coefficient statistically significant at 1%, 5% and 10% levels, respectively. t-ratios in parenthesis

All together, this means that all our three hypotheses are well supported by the data of the market share equations. All time in the market, order of entry and switching costs have a positive and significant influence on market share. Moreover, the fact that the importance of the effect of the group of four variables measuring first mover effects is smaller when switching costs are introduced, together with the evidence that points out that switching costs are explained by first moving and that first moving has a positive and significant effect on market share in the absence of switching costs, lead us to conclude that switching costs are an important *mediator* of the impact of first moving on market share. In other words, we provide evidence pointing out that switching costs

are, in fact, one of the isolating mechanisms used by first movers in order to maintain competitive advantage.

Up to this point, we have focused on the market share equations. Nevertheless, as pointed out by Vanderwerf and Mahon (1997) first mover effects are much more likely to be detected when market share is used as the dependent variable than when profitability is used. Furthermore, the use of profitability in the estimation of first mover effects is less common, perhaps given the higher availability of information on sales than the one on profits. The estimations presented in columns 4 to 6 of Table 1 report OLS estimates on our profitability equations. The sequence followed for testing hypotheses 1 to 3 is analogous to the one followed in the three previous models. The differences stem from the fact that we change the identity of the dependent variable and also use a Herfindahl Index for measuring concentration.⁴

The first observation from models 4 to 6 is that the explanation of profitability is far more elusive than that of market share. All the equations present an R-Squared statistic with values below half those of the ones presented in the market share equations. As before, the full model presented in column 6 is shown to be preferable to the two less complete models estimated in columns 4 and 5, as evidenced by the significance of the F-tests performed.

Similarly to its market share counterpart, equation 4 estimates a model in which only the set of variables accounting for first mover effects are included. Again, all of them are positive and significant, supporting hypothesis 1 and the idea that first moving is important in the European mobile market. Furthermore, the pattern of influences of the dummies accounting for the order of entry is clearly respected, with the pioneers having a higher profitability than the followers and these, in turn, also presenting a

⁴ The introduction of concentration in the market share equation does not change our conclusions.

higher return than the third entrants. Among the control variables, only the Index of Economic Freedom is significant and negative, apparently pointing to the fact that those countries which allow market forces to operate more freely are the ones in which profitability in the mobile market is lower.

Equation 5 introduces the switching costs variable in the estimation and eliminates the set of variables accounting for first moving. Switching costs have a very significant and positive effect on profitability, supporting hypothesis 2. As for the control variables, the model does not change, with only the Index of Economic Freedom having a negative and significant influence on the returns of mobile operators.

Finally, model 6 tests for the mediation effect of switching costs on profitability. Whereas the time in the market variable is significant and positive (although with a coefficient of a lower value), the set of dummies measuring order of entry lose their significance. Furthermore, the switching costs variable is positive and significant. In other words, switching costs perfectly mediate the influence of the order of entry variables on profitability, what offers support to hypothesis 3.

5. CONCLUSIONS AND DISCUSSION

This paper has tested the effect of first mover advantages in a context in which consumers bear switching costs. Contrary to other papers that focus on market share, we also estimate a profitability equation from which we can infer the effect of pioneering on the returns of mobile operators. This is important, given that the evidence shows that the likelihood of finding first mover effects is higher when market share is the dependent variable. Furthermore, our focus on markets that have experienced high rates of growth in the number of subscribers provides us with an extreme scenario in which to test the first mover theory.

Our results point, without any doubt, that time in the market and order of entry are important determinants of both market share and profitability. Those firms that entered first have more market share and are more profitable than those entering late. Importantly, the idea that first mover effects are divisible into a component that depends on the order of entry and a second element that is a function of the time in the market is fully supported by our data. Furthermore, our results point out that at least a part of the first mover effect may be explained in terms of switching costs, given that this variable arises as an important mediator of the relationship between time in the market and order of entry and both market share and profitability.

Among the control variables, we have to highlight the importance of the negative and significant coefficient associated to the Index of Economic Freedom in all the estimations. Its interpretation is perhaps clearer in the case of our profitability equations. Those countries with more economic freedom are the ones in which mobile operators obtain lower levels of performance. This result is important if we relate it to the economic models that investigate on the idea of welfare loss. To the extent that higher profitability were related to lower consumer surplus, less economic freedom would have implied that welfare loss could be higher in markets with a lower Index of Economic Freedom.

The conclusions of this paper have clear implications for the study of first mover advantages. First, the degree of explanation of the first mover effect and the isolating mechanisms seems to be higher in an equation of market share than in the profitability equation. This is not only evidenced by our estimations, but it is also a conclusion that may be extracted from extant research in which first mover advantages are more likely to be found in market share models than in profitability equations. In our opinion, given that the ultimate goal of a firm's operations is to create value, the detection of first

mover advantages should be accomplished through models of profitability. The evidence seems to confirm the intuition that market share shows a higher degree of inertia than profitability. In some contexts, such as the one of the mobile phone market, the presence of switching costs may mean that those firms with a higher market share are also the ones earning higher returns, linking both market share and profitability.

Second, our results shed light on the role of switching costs at the time of securing competitive advantage. They position us close to the suggestions of Amit and Zott (2001) and Shapiro and Varian (1998) and far from the contention of Mata, Fuerst and Barney (1995), who seem to attribute switching costs a minor role, at least in the context of information technologies. The view defended by the latter group of authors describes a rational buyer that anticipates the possibilities of ending locked-in and a seller that cares about its reputation. However, the evidence seems to point that either consumers and sellers are not so rational or, even if they anticipate the consequences of buying the product of a particular provider, they also anticipate a higher degree of satisfaction that compensates it. An additional possibility could be that bearing switching costs may be seen as a necessary condition if the consumer wants to use the service of product, given that all the offerings include them to a certain extent. In any case, there is a full list of settings in which switching costs provide the firm with a way of extracting a profit from consumers, ranging from the use of technologies that form systems to psychological or contractual costs that make it difficult to change for the consumer.

Third, the fact that the market in which we are testing our hypotheses is a high growth market leads us to think that first mover effects may be more persistent than it is sometimes claimed. As mentioned in the introduction, Suarez and Lanzolla (2007) posit that the likelihood of detecting first mover advantages should be lower in markets with

abrupt growth. Therefore, the detection of first mover advantages in the mobile phone market means that the consequences of first moving are present even in a setting that is not very adequate for them. Given the sound logic behind the hypothesis developed by these authors, it seems necessary to test it in other settings, in order to see whether the mobile phone market is an especial case. An extension of the analyses performed in this paper would be to take into account the differences in the speed of growth among the various national markets included in our sample, in order to see whether any differences exists. For example, the idea that the effect of switching costs as an isolating mechanism is lower in high growth markets should not be difficult to test.

Of course, the previous explanation should not forget the second environmental dimension introduced by these authors, namely, the pace of technology evolution. First, the standardization introduced in the European market could have reduced the role of product innovation as a competitive weapon, shortening the range of competitive actions with which followers could potentially overcome the advantage of the pioneer. Second, standardization could have been of high importance in a context in which network externalities do exist, reducing the uncertainty surrounding the decision to buy and providing pioneers with a time to build a base of consumers.

Finally, we did not emphasize the differences in institutional factors among countries. However, the negative and significant sign of our Index of Economic Freedom should be taken into account. These factors should condition the rules under which competition takes place in the market and, to some extent, either erode or strengthen the ability of first movers to keep their advantage. This could be especially true in a context in which pioneers are, in the majority of the cases, former monopolists, from which followers sometimes hire the network to offer the services to consumers.

An institutional context guarantying the same status to first entrants and followers could foster competition that contributes to the erosion of the advantage of the first entrant.

A related idea is the one that links the literature on first moving with the regulatory context. For example, Nehrt (1998) suggests the need to take into account the differences in regulation among countries when testing first mover advantages. Additionally, deregulation of some markets could have been endogenous. For example, it could have been conditioned by the influence of lobbying groups (Duso and Jung, 2007). Governments could also have chosen the timing of deregulation of their mobile markets as a function of the productivity of their national firms (Duso and Roller, 2003). This could help us to explain the origins of the first mover advantage and why it is more important in some markets.

Our paper also has limitations. First, even if we were able to control for one of the mechanisms proposed by the literature, we did not control for the operation of others. In fact, many of the variables accounting for time in the market and the order of entry remain positive and significant, even once we introduce the switching costs variables. This could be a minor problem in the case of technological leadership, given that the potential differences among the operators may have been blurred by the existence of certain degrees of standardization and the creation of supranational organisms. Nevertheless, despite our success in explaining the first mover advantage through switching costs, to the extent that the variables measuring the advantage of the pioneer remain significant in a performance equation we should not feel complete satisfaction. As mentioned above, future research on first mover advantages should attempt to completely account for these mediating mechanisms and the moderating variables suggested by the literature.

Second, we were also unable to establish differences among firms based on the different strategies followed by them. For example, we have not been able to test the contention that price or advertising could be used as effective mechanisms to lower the first mover advantage (Lieberman and Montgomery, 1998). The integration of the competitive strategy followed by the firm in a model of performance should be important. In fact, research has shown that competitive strategy is more important than entry timing to explain performance (De Castro and Chrisman, 1995).

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TABLE 2. NUMBER OF OPERATORS BY QUARTER AND YEARS IN THE MARKET
(EUROPEAN COUNTRIES)

Term	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1998-4	8	3	7	3	6	9	14	2	--	--	--	--	--	--	--	--	52
1999-1	10	5	8	3	3	10	14	4	--	--	--	--	--	--	--	--	57
1999-2	11	5	6	5	--	9	14	8	--	--	--	--	--	--	--	--	58
1999-3	7	9	1	8	2	7	11	13	--	--	--	--	--	--	--	--	58
1999-4	6	9	3	7	3	6	9	14	2	--	--	--	--	--	--	--	59
2000-1	3	10	5	8	3	3	10	14	4	--	--	--	--	--	--	--	60
2000-2	4	11	5	6	5	--	9	14	8	--	--	--	--	--	--	--	62
2000-3	4	7	9	1	8	2	7	11	13	--	--	--	--	--	--	--	62
2000-4	3	6	9	3	7	3	6	9	14	2	--	--	--	--	--	--	62
2001-1	4	3	10	5	8	3	3	10	14	4	--	--	--	--	--	--	64
2001-2	2	4	11	5	6	5	--	9	14	8	--	--	--	--	--	--	64
2001-3	2	4	7	9	1	8	2	7	11	13	--	--	--	--	--	--	64
2001-4	2	3	6	9	3	7	3	6	9	14	2	--	--	--	--	--	64
2002-1	--	4	3	10	5	8	3	3	10	14	4	--	--	--	--	--	64
2002-2	--	2	4	11	5	6	5	--	9	14	8	--	--	--	--	--	64
2002-3	1	2	4	7	9	1	8	2	7	11	13	--	--	--	--	--	65
2002-4	1	2	3	6	9	3	7	3	6	9	14	2	--	--	--	--	65
2003-1	3	--	4	3	10	5	8	3	3	10	14	4	--	--	--	--	67
2003-2	3	1	2	4	11	5	6	5	--	9	14	8	--	--	--	--	68
2003-3	3	1	2	4	7	9	1	8	2	7	11	13	--	--	--	--	68
2003-4	4	1	2	3	6	9	3	7	3	6	9	14	2	--	--	--	69
2004-1	2	3	--	4	3	10	5	8	3	3	10	14	4	--	--	--	69
2004-2	1	3	1	2	4	11	5	6	5	--	9	14	8	--	--	--	69
2004-3	--	4	1	2	4	7	9	1	8	2	7	11	13	--	--	--	69
2004-4	--	4	1	2	3	6	9	3	7	3	6	9	14	2	--	--	69
2005-1	--	2	3		4	3	10	5	8	3	3	10	14	4	--	--	69
2005-2	--	1	3	1	2	4	11	5	6	5	--	9	14	8	--	--	69
2005-3	--	--	4	1	2	4	7	9	1	8	2	7	11	13	--	--	69
2005-4	--	--	4	1	2	3	6	9	3	7	3	6	9	14	2	--	69
2006-1	--	--	2	3	--	4	3	10	5	8	3	4	9	14	4	--	69
2006-2	--	--	1	3	1	2	4	11	5	6	5	1	8	14	8	--	69
2006-3	--	--	--	4	1	2	4	7	9	1	8	3	6	11	13	--	69
2006-4	--	--	--	4	1	2	3	6	9	3	7	4	5	9	14	2	69
2007-1	--	--	--	2	3	--	4	3	10	5	8	4	3	9	14	4	69

Source: Global Matrix

TABLE 3. DESCRIPTIVE STATISTICS

(MARKET SHARE MODEL)					
Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Market share	1,491	0.302	0.154	0.001	0.736
Time from entry (years)	1,491	7.464	3.382	0	15
Pioneer	1,491	0.453	0.498	0	1
Second entrant	1,491	0.205	0.404	0	1
Third entrant	1,491	0.283	0.451	0	1
Switching costs	1,491	18.122	12.214	-18.280	56.509
Per capita income/10,000	1,491	2.889	0.601	1.292	4.717
Index of Economic Freedom	1,491	69.412	6.681	55.600	82.400
(PROFITABILITY MODEL)					
Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Profitability	1,363	0.283	0.332	-8	0.580
Time from entry (years)	1,363	7.815	3.243	0	15
Pioneer	1,363	0.467	0.499	0	1
Second entrant	1,363	0.211	0.408	0	1
Third entrant	1,363	0.285	0.451	0	1
Switching costs	1,363	18.488	11.754	-18.280	56.509
Concentration	1,363	0.364	0.076	0.227	0.606
Per capita income/10,000	1,363	2.889	0.604	1.292	4.717
Index of Economic Freedom	1,363	69.357	66.060	55.6	82.4

TABLE 4. CORRELATION MATRICES

	1	2	3	4	5	6	7	8
Market share (1)	1							
Time from entry (years) (2)	0.5580	1						
Pioneer (3)	0.6971	0.5998	1					
Second entrant (4)	-0.0902	-0.0933	-0.4628	1				
Third entrant (5)	-0.4857	-0.3989	-0.5722	-0.3193	1			
Switching costs (6)	0.6251	0.3891	0.3730	0.1257	-0.3957	1		
Per capita income/10,000 (7)	-0.0003	0.2206	-0.0943	0.0291	0.0604	0.1770	1	
Index of Economic Freedom (8)	-0.0994	0.0583	-0.1621	0.0998	0.1204	0.0751	0.5636	1

	1	2	6	7	8	3	4	9	5
Profitability (1)	1								
Time from entry (years) (2)	0.4433	1							
Pioneer (6)	0.3179	0.6000	1						
Second entrant (7)	-0.0312	-0.1291	-0.4831	1					
Third entrant (8)	-0.2308	-0.4302	-0.5900	-0.3258	1				
Switching costs (3)	0.3749	0.3922	0.3685	0.1198	-0.3721	1			
Concentration (4)	0.0023	-0.1128	0.1924	0.0327	-0.2003	0.2295	1		
Per capita income/10,000 (9)	0.0500	0.2830	-0.0679	0.0472	0.0406	0.2625	0.1498	1	
Index of Economic Freedom (5)	-0.0294	0.1010	-0.1409	0.1230	0.1005	0.1522	-0.0893	0.5479	1

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